High-Energy Dense Oxidizers

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At a Glance

What is it?

- The High-Energy Dense Oxidizers (HEDO) Program is a research effort investigating next-generation energetic materials and concepts that will enable substantially higher performing ordnance with acceptable insensitivity standards.

How does it work?

- Technical efforts are directed toward molecular design, exploratory synthesis, investigation of physical and chemical properties and relationships, synthesis efficiencies, and process research and development of advanced energetic ingredients. When inserted into ordnance/propulsion systems, these new ingredients will increase system performance 10-fold while meeting insensitivity compliance objectives.

What will it accomplish?

- The development of new oxidizer ingredients will yield enormous program payoffs across Navy ordnance systems, such as torpedoes, warheads, strategic and tactical missile propellants. Process refinement and scale-up activities will provide consistent and reproducible materials for formulation applications.

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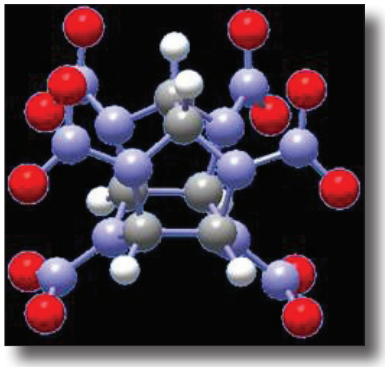

Advanced blast and propellant composition rely on ammonium perchlorate (AP) to assist combustion and detonation. Current AP systems have reached their engineered maximum efficiency, mandating the requirement for new ingredients to continue performance and sensitivity property advances.

The Office of Naval Research (ONR) Advanced Reactive and Energetic Materials Program seeks to develop next-generation energetic materials (e.g., explosives, propellants and reactive materials) and technologies to enable substantially higher performance ordnance.

New ordnance must be affordable, adaptive in size to fit a family of delivery systems, and able to contain sufficient energy to defeat the target. Science and technology must provide ordnance formulation flexibility to meet specific future naval mission requirements; comply with safety and environmental regulations; and achieve significant enhancements in delivery energy in compact volumes while being resistant to catastrophic failure in extremely stressful environments, such as handling aboard carriers and long-term storage.

Future mission requirements impose challenging and conflicting demands for weapon systems, but advancing high-energy dense oxidizers ultimately will translate into greater national security as the Navy conducts its global mission.

Quantified payoffs include:

- Ten-fold increase in system performance
- IM compliant, resistant to catastrophic failures
- Prolonged storage life (40-50 years)
- Safe handling onboard ships
- Flexibility in the size and weight of weapon systems

Research Opportunities:

- Develop a new class of ingredients that can surpass the oxygen content of AP
- Develop a fundamental understanding of new molecule designs for HEDO synthesis with: ingredient density of 2 g/cc, oxygen content greater than AP, melting point greater than1500 degrees Celcius with a minimum number of synthesis steps
- Develop ingredients with sensitivities no worse than RDX/HMX, low hydrogen and carbon content, high oxygen and nitrogen content